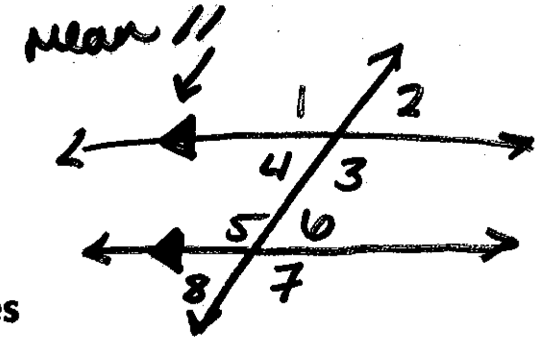


3-2 Angles and Parallel Lines

Theorems and Postulates:

Postulate 3-1: Corresponding Angles Postulate
If two parallel lines are cut by a transversal, then each pair of corresponding angles are congruent

$\angle 1 \cong \angle 5$
$\angle 3 \cong \angle 7$

Theorem 3-1: Alternate Interior Angles Theorem
If two parallel lines are cut by a transversal, then each pair of alternate interior angles are congruent

$\angle 4 \cong \angle 6$, $\angle 3 \cong \angle 5$

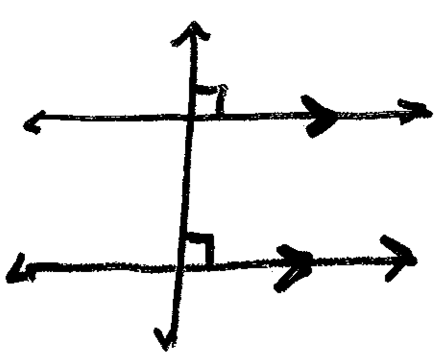
Theorem 3-2: Consecutive Interior Angles Theorem
If two parallel lines are cut by a transversal, then each pair of consecutive interior angles are supplementary

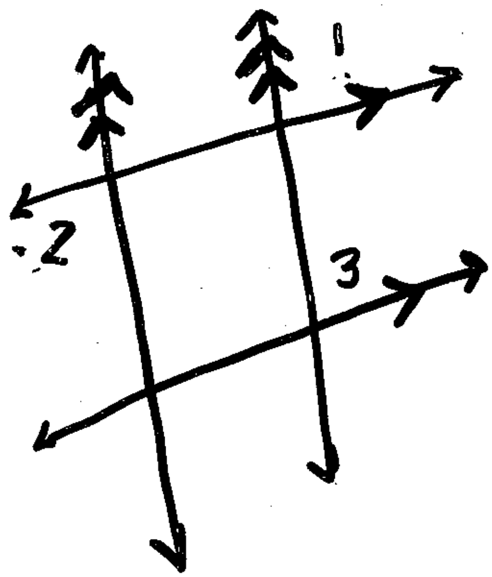
$\angle 4 + \angle 5 = 180$ $\angle 3 + \angle 6 = 180$

Theorem 3-3: Alternate Exterior Angles Theorem
If two parallel lines are cut by a transversal, then each pair of alternate exterior angles are congruent

$\angle 1 \cong \angle 7$ $\angle 2 \cong \angle 8$

Theorem 3-4: Perpendicular Transversal Theorem
In a plane, if a line is perpendicular to one of two parallel lines, then it is perpendicular to the other.





$m\angle 1 = 3x+40$

$m\angle 2 = 2(y-10)$

$m\angle 3 = 2x+70$

Find x and y

Angles 1 and 3 $\cong$

$\angle 1 \cong \angle 3$

$$\begin{aligned} 3x+40 &= 2x+70 \\ -2x \quad & \quad -2x \\ \hline x+40 &= 70 \\ -40 \quad & \quad -40 \\ \hline \end{aligned}$$

$\boxed{x=30}$

$\angle 1 \cong \angle 2$

$3x+40$

$3(30)+40$

$$\frac{130}{2} = \frac{\cancel{2}(y-10)}{\cancel{2}}$$

$$\begin{aligned} 65 &= y-10 \\ +10 \quad & \quad +10 \\ \hline \end{aligned}$$

$\boxed{y=75}$

$$\begin{aligned} 130 &= 2y-20 \\ +20 \quad & \quad +20 \\ \hline \frac{150}{2} &= \frac{2y}{2} \end{aligned}$$

$y = 75$

3-3 Slopes of Parallel and Perpendicular Lines

Math Vocabulary:

1. Slope: ratio of a line's vertical rise to its horizontal run
2. Perpendicular lines:

Slope:

Finding slope given 2 points:

The slope m of a line containing two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula:

$$M = \frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run} = \frac{\Delta y}{\Delta x}$$

Δ = "delta" means change in

- Horizontal Slope is $M = 0$
- Vertical Slope is undefined $\frac{\#}{0}$
- Increasing slope is positive , big x → big y "rising"
- Decreasing slope is negative big x → smaller y "falling"

* Example 1: Find the slope of the line through points (-1,6) and (4,2)

$$\frac{2-6}{4--1} = \boxed{\frac{-4}{5}} \qquad \frac{6-2}{-1-4} = \frac{4}{-5}$$

Is the line increasing or decreasing?

Example 2: Find the slope of the line through points (-2,-3) and (-6,-5)

$$\frac{-3--5}{-2--6} = \frac{2}{4} = \frac{1}{2} \qquad \frac{-5++3}{-6--2} = \frac{-2}{-4} = \frac{1}{2}$$

Is the line increasing or decreasing?

Parallel and Perpendicular Lines: iff

Postulate 3-2: Two nonvertical lines have the same slope if and only if they are parallel.

Postulate 3-2: Two nonvertical lines are perpendicular if and only if the product of their slopes is -1.

* mult.

slopes are opposite reciprocals $\frac{2}{3} \cdot -\frac{3}{2} = -1$

Example 3: Find the slope of the line parallel to the line passing through points (3,6) and (5,-2).

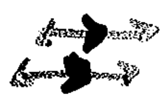
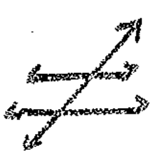
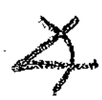
Is a line through points (-3,-2) and (9,1) parallel to these lines?

Example 4: Find the slope of the line perpendicular to the line passing through points (9,-3) and (6,-10).

$m = \frac{-10 - -3}{6 - 9} = \frac{-7}{-3} = \frac{7}{3}$ $\boxed{-\frac{3}{7}}$

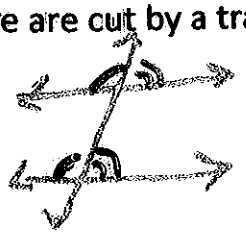
3-4 Proving Lines are Parallel

Math Abbreviations:

1. Parallel: // 
2. Perpendicular: $\perp$ 
3. Two lines cut by a transversal: 
4. Angles: $\angle$ 

Theorems and Postulates:

Postulate 3-4:
If two lines in a plane are cut by a transversal so that corresponding angles are congruent, then the lines are //



Theorem 3-5:

If two lines in a plane are cut by a transversal so that a pair of alternate exterior angles are congruent, then the lines are ||

Theorem 3-6:

If two lines in a plane are cut by a transversal so that a pair of consecutive interior angles are supplementary, then the lines are ||

Theorem 3-7:

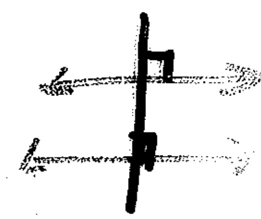
If two lines in a plane are cut by a transversal so that a pair of alternate interior angles are congruent, then the lines are ||

Postulate 3-5: Parallel Postulate

If there is a line and a point not on a line, then there exists exactly one parallel line through the point

Theorem 3-8:

In a plane, if two lines are perpendicular to the same line, then the lines are ||



Proof of Theorem 3-5

Proof:

Prove: If two lines in a plane are cut by a transversal so that a pair of alternate exterior angles are congruent, then the two lines are parallel.

Given: $\angle 1 \cong \angle 2$

Prove: a || b

Statements	Reasons
1. $\angle 1 \cong \angle 2$	
2.	
3.	
4.	

3-5 Parallel Lines & Distance

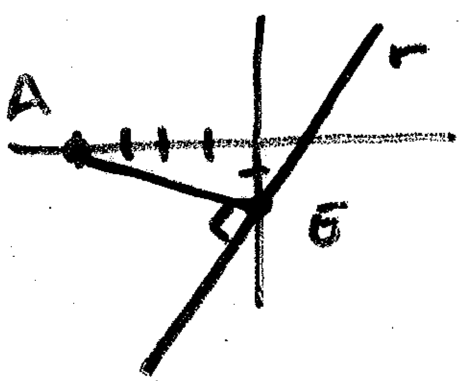
Math Vocabulary:

1. Distance between a point and a line: Is the length of the segment $\perp$ to the line from the point
2. Equidistant: the distance between 2 parallel lines is always the same. 
3. Distance between two parallel lines: is the distance between one of the lines and any other point on the other line ($\perp$)

Distance Formula:

$$d=\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$$

The line segment constructed from point A (-4,0) perpendicular to the line r intersects at E (0,-2). Find the distance between the point and the line.



$$\sqrt{(4)^2+(2)^2}$$

$$\sqrt{16+4}$$

$$\sqrt{20}$$

$$\approx 4.47$$